Fishery Data Series No. 13-53

Origins of Chinook Salmon in the Yukon River Fisheries, 2010

by

Larry DuBois

December 2013

Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

Symbols and Abbreviations

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Weights and measures (metric)	
centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm
Weights and measures (English)	
cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd
Time and temperature	
day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s
Physics and chemistry	
all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General	
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics	
all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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by
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December 2013

This investigation was financed by the Yukon River Restoration and Enhancement Funds under project URM 19N-10 and USFWS through Yukon River Salmon Agreement Treaty Implementation funds under Agreement No. 701815G339.

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This document should be cited as:
DuBois, L. 2013. Origins of Chinook salmon in the Yukon River fisheries, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 13-53, Anchorage.

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ABSTRACT

The stock and age composition of the Chinook salmon *Oncorhynchus tshawytscha* harvest within the Yukon River drainage was estimated for 2010. Stock composition was estimated by genetic analysis for 3 geographically-based stock groups termed Lower, Middle, and Upper. Stock estimates from sampled fish were applied to specific harvests across all age classes. Ages of sampled fish were determined from scales; age composition was estimated as the sample proportions in each age class. Age composition estimates were applied to specific harvests across all stock groups. The total estimated Yukon River harvest in 2010 was 56,429 Chinook salmon; of these, 17.8% were estimated to be of Lower, 32.7% Middle, and 49.5% Upper stock group origin. Age-1.3 fish dominated the harvest at 53.1%, age-1.4 fish were 27.6%, age-1.2 fish were 15.3%, and other age classes combined were 4.0%.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, Yukon River, stock composition, age composition, harvest, genetic stock identification, age-1.4, age-1.3, age-1.2, stock group

INTRODUCTION

The Yukon River drains roughly 330,000 square miles, originates in northern British Columbia, and flows 2,300 river miles (rm) to its terminus at the Bering Sea (Estensen et al. 2012; Figures 1 and 2). Chinook salmon *Oncorhynchus tshawytscha* spawn in major tributaries throughout the drainage. Yukon River Chinook salmon are harvested annually in various fisheries in both marine and fresh waters. Within the Yukon River, returning adult salmon are harvested in subsistence and personal use fisheries in Alaska, aboriginal and domestic fisheries in Canada, and commercial, test, and sport fisheries in Alaska and Canada. Sport fisheries, a very minor component of harvest overall, primarily occur in lower river tributaries, Tanana River tributaries, and in Canada. The average annual harvest of Chinook salmon within the Yukon River drainage from 2000 through 2009 was 81,059 fish; harvests within Alaska averaged 73,173 fish (JTC 2011).

In 2002, the Yukon River Salmon Agreement was signed as part of the Pacific Salmon Treaty (hereafter referred to as Treaty), whereby the U.S. and Canada agreed to harvest sharing of Chinook salmon that migrate through Alaska waters and spawn in the Yukon Territory and British Columbia. Since 1985, both nations have been engaged in the cooperative management and conservation of stocks spawning in Canada (JTC 2011). Stock composition estimates of harvests in Alaska provide valuable information for management and conservation of Chinook salmon throughout the Yukon River drainage, and aid in fulfillment of Treaty objectives.

Since 1981, the Alaska Department of Fish and Game (ADF&G) has estimated the stock and age composition of Chinook salmon harvests in the Yukon River. Stock and age compositions of harvests are needed to construct brood tables, which enable run reconstructions necessary for scientifically based escapement goals and forecasts of future runs. Understanding the relative contribution of Canadian-origin fish to Alaska harvests is foremost in meeting Treaty objectives and in conservation and management of this stock group.

In 1997, an expert panel convened by the U.S. and Canadian Joint Technical Committee (JTC) determined that scale pattern analysis was sufficiently accurate to provide stock identification information for management and research pending the development of improved genetic stock identification capabilities (Schneiderhan 1997). Scale pattern analysis was used to differentiate stock of origin for Chinook salmon harvested in the Yukon River from 1981 to 2003 (e.g., DuBois 2005). Lingnau and Bromaghin (1999) identified Lower, Middle, and Upper Yukon River stock groups using unique scale signatures for these groups. The Lower stock group includes Alaska tributary streams from the Andreafsky River to near the confluence with the

Tanana River and the lower Koyukuk River drainage. The Middle stock group includes Alaska tributary streams upstream from the Tanana River confluence, and the upper Koyukuk and Tanana River drainages. The Upper stock group is Canadian-origin fish.

Based on surveys of genetic variation among Chinook salmon populations in the Yukon River drainage, a baseline of genetic information was completed and used for genetic stock identification using allozyme loci (Beacham et al. 1989; Wilmot et al. 1992; Templin et al. 2005). Two types of genetic markers, single nucleotide polymorphisms (SNPs) and microsatellites, were investigated to provide a replacement for the allozyme baseline. In 2003 a survey of SNPs in Yukon River Chinook salmon demonstrated that stock identification information could be obtained in an accurate and efficient manner (Smith et al. 2005). With the exception of 2005, when microsatellite markers were used, SNPs have been used from 2004 through 2010 for stock composition of Yukon River Chinook salmon. The 3 broad scale reporting groups from genetic analysis are consistent with the 3 groups from scale pattern analysis.

This report presents stock and age class components of the Chinook salmon harvest in the Yukon River drainage. To accomplish this, genetic stock and age class compositions were determined from samples representative of specific harvests by village, district, and fishery. Estimated stock and age class proportions were applied to location and fishery specific harvest estimates, and then estimates of total harvest by each stock and age class were produced by summing across locations and fisheries. The resulting stock and age composition of the 2010 Chinook salmon harvest is the focus of this report.

OBJECTIVES

The objectives of this project are to estimate the total Yukon River Chinook salmon harvest by 1) stock group and 2) age class during the 2010 season.

METHODS

HARVEST SAMPLING

Within the Alaska portion of the drainage, the Yukon River is split into 6 fishing districts for management, Y-1 through Y-6, numbered sequentially progressing from the river mouth (Y-1) to the Canadian border (Y-5), and Tanana River (Y-6; Figure 1). Commercial fisheries primarily occur in Districts 1 and 2; however, they are occasionally executed in Districts 4 and 6. Subsistence fishing occurs throughout the river and major tributaries.

Chinook salmon from harvests throughout the drainage were sampled for age (from scales) and stock group (from genetic tissue). Mainstem Yukon River sampling locations include villages, fish camps, and test fisheries. Harvest samples from Districts 2 and 6 sport fisheries, District 6 subsistence, and Koyukuk River subsistence were not collected. Escapement samples collected from tributary streams draining into these locations were substituted for harvest age composition. ADF&G, U.S. Fish and Wildlife Service, and other non-governmental organizations collected these samples from Chinook salmon.

Harvest samples for genetic and age data, from specific locations, were used to estimate stock and age composition of specific harvests. Stock and age composition of harvests not sampled were estimated from other sampled harvests or test fishery catches that were presumed similar. Subsistence harvest estimates were available from specific villages (Jallen et al. 2012); however, stock (Decovich and Howard 2011) and age information (Schumann and DuBois 2011) were in some cases combined and applied to the subsistence harvest of several villages to represent a reported sampling location.

Genetic Collection, Processing and Analysis

Tissue samples for genetic analyses were collected concurrent with scale samples. Axillary process tissues were collected using clippers or scissors; approximately three-fourths was removed and put into individually numbered 2 ml vials filled with denatured ethanol. These vials were shipped to the ADF&G Gene Conservation Laboratory for processing. Stock composition estimates for 3 broad scale stock reporting groups were generated from the harvest samples by location and, for test fisheries, temporally. Complete genetics methodology is available in DeCovich and Howard (2011). For this report, Lower Yukon, Middle Yukon, and Canada stock reporting groups in Decovich and Howard (2011) are referred to as Lower, Middle, and Upper stock groups.

Scale Collection, Processing, and Aging

Scales were removed from the preferred area of the fish for age determination and mounted on gum cards (INPFC 1963). Three scales were collected from each Chinook salmon to allow for the incidence of regenerated scales. Scales were impressed in cellulose acetate using methods described by Clutter and Whitesel (1956); impressions were magnified and examined in a Microfiche reader. Age was determined by counting the number of freshwater and marine annuli, the regions of the scale where the circuli, or rings, are tightly spaced, and represent slower growth rates associated with winter conditions (Mosher 1969). Ages were recorded using European notation: number of freshwater annuli separated by a decimal from number of marine annuli. Total age from the brood year is the sum of freshwater and marine annuli plus 1 to account for time spent in the gravel before hatching.

Stock and Age Assignment

For each harvest the number of fish per stock group and age class was estimated as follows.

Denote,

$N_{d,i,j}$: The number of salmon at *d-th* harvest group, *i-th* stock, and *j-th* age;

$N_{d,k}$: The number of salmon at *d-th* harvest group and *k-th* period;

$Ps_{d,i,k}$: Proportion of *i-th* stock at *d-th* harvest group and *k-th* period;

$Pa_{d,j,k}$: Proportion of *j-th* age at *d-th* harvest group and *k-th* period.

The estimated harvest by harvest group, stock, and age class is then,

$$\hat{N}_{dij} = \sum_{k} (\hat{N}_{d,k} \cdot \hat{P}s_{d,i,k} \cdot \hat{P}a_{d,j,k})$$

Stock and age estimates may be applied to the harvest from an individual village, but typically stock and age estimates from several locations were combined and applied to the subsistence harvest of several villages. Stock composition estimates for 2 or more genetic sampling locations were combined by averaging the contributing stock composition estimates. Ages for 2 or more sampling locations were combined by either averaging age compositions of contributing sample locations or pooling ages of all samples from contributing locations and deriving an age composition of the pooled set. Subsistence harvests by village, or groups of villages, were summed to obtain district-wide estimates by stock and age class. Subsistence harvest estimates included test fishery catches donated to subsistence; therefore stock and age estimates from test fisheries were used when needed.

Commercial

A directed Chinook salmon commercial fishery did not occur in 2010, however Chinook salmon caught incidentally in the summer chum salmon *O. keta* directed fishery were allowed to be sold. Mesh size was restricted to 6 inches or less to target chum and conserve Chinook salmon. In District 1, all 8 commercial periods were sampled for age and genetic data and in District 2, 6 of 7 periods were sampled.

Age and genetic composition from commercial harvest periods were pooled. Samples from District 2 periods, one to several days later than District 1, were pooled with samples from District 1 periods. These samples were combined in a manner to meet genetic sample size goals (DeCovich and Howard 2011). Combining samples from Districts 1 and 2 assumes the harvests were similar in age and stock composition as the run passed through these districts.

Age and genetic samples from District 1, Period 1 (June 28) and District 2, Period 1 (July 1) were pooled and these combined estimates were used for the age and stock composition of each respective period’s commercial harvest. Likewise, age and genetic samples from District 1, Period 2 (July 2) and District 2, Period 2 (July 4) were pooled; and age and genetic samples from District 1, Periods 3 and 4 (July 3 and 6) and District 2, Period 3 (July 7) were pooled. Age samples from District 1, Periods 5 and 6 (July 9 and 11) and District 2, Periods 4 and 5 (July 10 and 12) were pooled. Age samples from District 1, Periods 7 and 8 (July 13 and 15) and District 2, Period 6 (July 14) were pooled. Genetic samples from District 1, Periods 5 through 8 (July 9, 11, 13, and 15) and District 2, Periods 4 through 7 (July 10, 12, and 14) were pooled. These combined estimates were used to estimate the Chinook salmon commercial harvest stock composition of from each respective period and for the last period in District 2.

Subsistence

Subsistence harvests were sampled to estimate their age and stock composition in District 1; District 3 (Holy Cross); District 4 (Kaltag, Nulato, Bishop Rock, Galena, and Ruby); and District 5 (Tanana, Rampart Rapids, and Fort Yukon). Age samples only were collected from harvests in Anvik (District 4), Yukon River mainstem near Hess Creek (District 5), and Eagle (District 5). Subsistence harvest estimates were available by village (Jallen et al. 2012). Some of the harvest samples were used directly to estimate age and stock composition of harvest from a specific village. Most of the harvest samples were combined and stock compositions were applied to the total harvests from groups of villages. Where subsistence harvest samples were lacking, samples from nearby test fisheries were substituted to estimate the harvest stock composition from those locations.

Samples from the District 1 subsistence harvest were combined with samples from the Lower Yukon test fishery (LYTF)[1] to estimate age composition for the District 1 subsistence harvest. Proportions by age were averaged from the subsistence harvest (“Chum” and “King” meshes)

[1] Harvests from the Lower Yukon test fishery were donated to local communities in the district for subsistence use and, therefore, comprise a component of subsistence harvest in District 1.

and LYTF. The genetic samples collected from the District 1 subsistence harvests were inadequate to estimate stock composition. Stock composition estimates from 2 LYTF strata (June 11–19 and June 20–25) were averaged to represent the District 1 subsistence harvest.

District 2 subsistence harvests were not sampled. Age samples collected from fish caught with mesh 5.25 inches or larger from the Pilot Station sonar test fishery (rm 120) were used to represent age composition for the District 2 subsistence harvest. Stock composition estimates from 2 Pilot Station sonar test fishery strata (June 12–21 and June 22–28) were averaged to represent stock composition of District 2 subsistence harvest. Age and genetic samples from the subsistence harvest in the village of Holy Cross (rm 279), collected by Tanana Chiefs Conference (TCC), were used to estimate the age and stock composition of the District 3 subsistence harvest.

The District 4 subsistence harvest age and stock estimates were divided between mainstem and upper Koyukuk River harvest estimates by village (Jallen et al. 2012). Mainstem Yukon River subsistence harvests in District 4 occur along 375 river miles, from the District 3/4 boundary (rm 306) to the District 4/5 boundary (rm 681; Figure 1, Estensen et al. 2012). The City of Kaltag collected age and genetic samples from fish harvested near Kaltag (rm 450). TCC contracted with fishermen to collect age and genetic samples from harvests near Nulato (rm 484), Bishop Rock fish camp (rm 514), and Galena (rm 530). Age samples only were collected from harvests near Anvik (rm 317). Ruby Tribal Council collected age and genetic samples from harvests near Ruby (rm 581).

Subsistence harvest age samples from the villages of Anvik, Nulato, and Kaltag were pooled to estimate age composition from the District 4 villages of Anvik, Grayling (rm 336), Kaltag, and Nulato. Subsistence harvest genetic samples from the villages of Nulato and Kaltag were averaged to estimate stock composition from Anvik upstream to Kaltag. Subsistence harvest samples from Bishop Rock and Galena were used to estimate age and stock composition from the District 4 villages of Koyukuk (rm 502) and Galena; age samples were pooled and stock composition estimates were averaged. Subsistence harvest samples from Ruby were used to estimate the age and stock composition of the Ruby harvest.

Subsistence harvests in District 4 from the upper Koyukuk River villages (Alatna, Allakaket, Bettles, Hughes, and Huslia) were assigned to the Middle stock group based upon geographic location. Genetic classification of upper Koyukuk River baseline samples showed these fish belong in the Middle stock group (Templin et al. 2005; Smith et al. 2005). Age proportions were averaged from the Gisasa River weir and Henshaw Creek weir samples to estimate age composition from subsistence harvests in the Koyukuk River.

Mainstem Yukon River subsistence harvests in District 5 occur along 543 river miles, from the District 4/5 boundary (rm 681) to the U.S./Canada border (rm 1,224; Figure 1; Estensen et al. 2012). Age and stock estimates in District 5 were separated by location: Tanana village (rm 695); harvests upstream of Tanana to Fort Yukon (rm 1,002); harvests above Fort Yukon to the Canadian border; and harvests from Chandalar and Black rivers. TCC collected age and genetic samples from Tanana and Fort Yukon subsistence harvests and age samples only from subsistence harvests near Hess Creek (rm 789). Stan Zuray, Rapids Research Center, collected genetic samples from the subsistence fishery near Rampart Rapids (rm 731) and ADF&G collected age samples. Researchers from the University of Alaska Fairbanks, collected age samples from the Eagle subsistence harvest (rm 1,213).

Subsistence harvest samples from Tanana were used to estimate the age and stock composition of the Tanana harvest. Stock composition estimates from Rampart Rapids and Fort Yukon were averaged and applied to the District 5 subsistence harvest from upstream of Tanana to Fort Yukon. Upper stock composition estimates from Rampart Rapids and Fort Yukon were averaged to represent the Upper stock group. The combined Lower and Middle stock composition estimate from Rampart Rapids was split by assigning 0.075 of the combined proportion to the Lower stock group and assigning 0.925 to the Middle stock group (Nick DeCovich, Genetics Biologist, ADF&G, Anchorage, personal communication). These revised Lower and Middle stock composition estimates from Rampart Rapids and Fort Yukon were averaged for the Lower and Middle stock groups. Proportions by age were averaged from the Rampart Rapids, Hess Creek, and Fort Yukon sample proportions.

Subsistence harvests from above Fort Yukon to the Canadian border were assigned to the Upper stock group based on geographic location, assuming these fish are bound for Canada; the Eagle subsistence harvest samples were used for age composition.

The Chandalar and Black rivers subsistence harvest was assigned to the Middle stock group. Age composition from subsistence harvests occurring in these 2 rivers was estimated from the combined Rampart Rapids, Hess Creek, and Fort Yukon age proportion.

Sport

The sport fishery harvest from the Andreafsky and Anvik rivers, tributaries flowing into Districts 2 and 4, respectively, was assigned to the Lower stock group based on geographic location. Samples from the East Fork Andreafsky River and Anvik River were combined and used for age composition. Proportions by age class were averaged from the East Fork Andreafsky River weir and Anvik River sample proportions.

The age composition of the sport fish harvest in District 6 was estimated from the pooled escapement samples collected from the Chena and Salcha rivers. The majority of the sport fish harvests in the drainage are from Tanana River tributaries, of which, the Chena and Salcha rivers are major producers (Figure 1). The Tanana River drainage sport fish harvest was assigned to the Middle stock group based on geographic location.

Canada

Canadian harvest age composition was estimated from the Eagle sonar test fishery samples. All harvests occurring in Canada were assigned to the Upper stock group based on geographic location.

RESULTS

STOCK COMPOSITION OF COMMERCIAL HARVEST SAMPLES

The Lower stock group dominated in the samples from all 4 commercial harvest strata. Pooled samples from Period 1 in Districts 1 and 2 were estimated to be 0.649 Lower, followed by 0.246 Upper, and 0.105 Middle stock group. Pooled samples from Period 2 in Districts 1 and 2 were estimated to be 0.449 Lower, 0.341 Upper, and 0.209 Middle stock group. Pooled sample estimates from District 1 (Periods 3–4) and District 2 (Period 3) were 0.656 Lower, 0.213 Upper, and 0.131 Middle stock group. Pooled samples from District 1 (Periods 5–8) and

District 2 (Periods 4–7) were estimated to be 0.779 Lower, 0.140 Middle, and 0.081 Upper stock group. Sample sizes from commercial harvest strata ranged from 153 to 297 fish (Table 1).

STOCK COMPOSITION OF TEST FISHERY SAMPLES

The Upper stock group dominated in the samples from all 4 test fishery strata. Samples from LYTF (June 11–19) were estimated to be 0.537 Upper, followed by 0.240 Middle, and 0.223 Lower stock group. Samples from LYTF (June 20–25) were estimated to be 0.488 Upper, 0.337 Middle, and 0.175 Lower stock group. Sample sizes from LYTF strata were 228 and 219 fish (Table 1).

Samples from Pilot Station test fishery (June 12–21) were estimated to be 0.489 Upper, followed by 0.431 Middle, and 0.081 Lower stock group. Samples from Pilot Station test fishery (June 20–25) were estimated to be 0.487 Upper, 0.376 Middle, and 0.137 Lower stock group. Sample sizes from Pilot Station test fishery strata were 95 and 152 fish (Table 1).

STOCK COMPOSITION OF SUBSISTENCE HARVEST SAMPLES

The Upper stock group dominated in the subsistence harvest samples from 7 locations and the Middle stock group dominated from 2 locations. Sample sizes ranged from 100 to 240 fish from the 9 locations. Holy Cross samples were estimated to be 0.475 Upper, followed by 0.426 Middle, and 0.099 Lower stock group. Samples from Kaltag were estimated to be 0.510 Upper, 0.424 Middle, and 0.065 Lower stock group. Nulato sample estimates were similar to those from Kaltag. Samples from Bishop Rock were estimated to be 0.500 Upper, followed by 0.354 Middle, and 0.146 Lower stock group (Table 1).

Samples from upper District 4 villages had higher estimates for the Middle stock group. Galena samples were estimated to be 0.629 Middle, 0.303 Upper, and 0.068 Lower stock group. Ruby samples had the highest Middle stock group estimate (0.725), followed by 0.199 Upper, and 0.075 Lower (Table 1).

Samples from District 5 villages had higher estimates for the Upper stock group. Tanana samples were estimated to be 0.772 Upper, 0.216 Middle, and 0.012 Lower stock group. Samples from Rampart Rapids were estimated to be 0.798 Upper stock group and 0.202 Lower/Middle combined stock groups. Fort Yukon sample estimates were 0.904 Upper, 0.086 Middle, and 0.011 Lower stock group (Table 1).

AGE COMPOSITION OF COMMERCIAL HARVEST SAMPLES

Age-1.2 fish dominated in the commercial harvest samples from Period 1 and age-1.3 fish dominated in the remaining 4 strata. Sample sizes ranged from 154 to 358 fish by strata. Pooled samples from Period 1 in Districts 1 and 2 were estimated to be 0.466 age-1.2 fish, followed by 0.397 age-1.3, and 0.131 age-1.4 fish. Pooled samples from Period 2 in Districts 1 and 2 were estimated to be 0.558 age-1.3, 0.292 age-1.2, and 0.110 age-1.4 fish. Pooled samples from District 1 (Periods 3 and 4) and District 2 (Period 3) were estimated to be 0.513 age-1.3 fish, followed by 0.300 age-1.2, and 0.161 age-1.4 fish. Pooled samples from District 1 (Periods 5 and 6) and District 2 (Periods 4 and 5) were estimated to be 0.528 age-1.3, 0.244 age-1.2, and 0.203 age-1.4 fish. Pooled samples from District 1 (Periods 7 and 8) and District 2 (Periods 6 and 7) were estimated to be 0.570 age-1.3 fish, followed by 0.237 age-1.2, and 0.175 age-1.4 fish (Table 2).

AGE COMPOSITION OF TEST FISHERY SAMPLES

Age-1.3 fish dominated in the samples from all 3 test fisheries, followed by age-1.4 and age-1.2 fish. Sample sizes ranged from 234 to 1,328 fish. LYTF samples were estimated to be 0.594 age-1.3 fish, followed by 0.334 age-1.4, and 0.041 age-1.2 fish. Samples from the Pilot Station test fishery were estimated to be 0.594 age-1.3, 0.291 age-1.4, and 0.090 age-1.2 fish. Eagle sonar test fishery sample estimates were 0.462 age-1.3, 0.417 age-1.4, and 0.074 age-1.2 fish (Table 2).

AGE COMPOSITION OF SUBSISTENCE HARVEST SAMPLES

Age-1.3 fish dominated in the subsistence harvest samples from 11 of 13 locations, and age-1.4 fish dominated from the Bishop Rock and Hess Creek samples. Samples from District 1 were estimated to be 0.558 age-1.3 fish, followed by 0.286 age-1.4, and 0.104 age-1.2 fish. Holy Cross sample estimates were 0.546 age-1.3, 0.369 age-1.4, and 0.024 age-1.2 fish. Samples from Anvik were similar to Holy Cross with 0.512 age-1.3 fish, followed by 0.389 age-1.4, and 0.037 age-1.2 fish. Kaltag samples were estimated to be 0.500 age-1.3 fish, followed by 0.371 age-1.4, and 0.073 age-1.2 fish. Nulato sample estimates were 0.588 age-1.3, 0.282 age-1.4, and 0.096 age-1.2 fish. Samples from Bishop Rock had the highest proportion of age-1.4 fish (0.491), followed by 0.434 age-1.3, and 0.047 age-1.2 fish (Table 2).

Samples from Galena, Ruby, Tanana, Rampart Rapids, and Fort Yukon had increased proportions of age-1.2 fish. Some or all of these fish were harvested using fish wheels. Samples from Galena were estimated to be 0.502 age-1.3 fish, followed by 0.307 age-1.4, and 0.144 age-1.2 fish. Ruby sample estimates were 0.587 age-1.3, 0.258 age-1.2, and 0.116 age-1.4 fish. Samples from Tanana were estimated to be 0.507 age-1.3 fish, and near equal proportions of 0.222 age-1.4, and 0.212 age-1.2 fish. Rampart Rapids sample estimates were 0.486 age-1.3, 0.400 age-1.2, and 0.086 age-1.4 fish. Samples from Hess Creek were estimated to be 0.460 age-1.4 fish, followed by 0.376 age-1.3, and 0.070 age-1.2 fish. Fort Yukon sample estimates were 0.575 age-1.3 fish, and near equal proportions of 0.209 age-1.4, and 0.190 age-1.2 fish. Samples from Eagle had the highest proportion of age-1.3 fish (0.629), followed by 0.240 age-1.4, and 0.086 age-1.2 fish. Subsistence harvest sample sizes ranged from 106 to 295 fish by location; with the exceptions of District Y-1 and Rampart Rapids, where sample sizes were 77 and 35 fish, respectively (Table 2).

AGE COMPOSITION OF ESCAPEMENT SAMPLES

Age-1.3 fish dominated in the escapement samples from all 6 locations. East Fork Andreafsky River weir sample estimates were 0.451 age-1.3 fish, followed by 0.413 age-1.2, and 0.098 age-1.4 fish; Gisasa River weir sample estimates were similar. Anvik River escapement samples were estimated to be 0.509 age-1.3, 0.348 age-1.2, and 0.116 age-1.4 fish; Chena River escapement sample estimates were similar. Henshaw Creek weir samples were estimated to be 0.572 age-1.3 fish, and near equal proportions of 0.208 age-1.4, and 0.193 age-1.2 fish. Salcha River escapement samples were estimated to be 0.575 age-1.3 fish, followed by 0.255 age-1.2, and 0.141 age-1.4 fish. Escapement sample sizes ranged from 208 to 624 fish by location; with the exceptions of the Anvik and Chena rivers, where sample sizes were 108 and 80 fish, respectively (Table 2).

TOTAL HARVEST

The 2010 U.S. and Canada total Chinook salmon harvest was 56,429 fish (Table 3). The Lower stock group harvest was 10,046 fish (17.8%); Middle stock group harvest was 18,465 fish (32.7%); and Upper stock group harvest was 27,918 fish (49.5%, Tables 3 and 4). The 2010 harvest was well below one-half of the 1981–2009 average and three-quarters of the 2005–2009 average (Table 5). In numbers of fish, the 2010 harvest was the fourth lowest on record; 3 of 4 of these low harvests occurred from 2008 to 2010 (Table 5). The Canadian harvest of 2,647 fish was the lowest on record. Comparing stock group harvest percentages with averages: the Lower stock was near average, the Middle stock was above average, and the Upper stock was below average (Table 6). In terms of age composition, age-1.3 fish comprised 53.1% (29,972 fish) of the total harvest, followed by age-1.4 fish (27.6%), and age-1.2 fish (15.3%, Tables 3 and 4). All minor age classes (age-1.1, -2.2, -2.3, -1.5, and -2.4) combined were 4.0% (851 fish) of the total harvest (Tables 3 and 4).

STOCK COMPOSITION BY DISTRICT

Commercial Districts 1 and 2

The Lower stock group dominated the District 1 commercial harvest (64.8%), followed by 21.7% Upper, and 13.5% Middle (Table 4; Figure 3). In District 2, percentages were similar, with the Lower stock group comprising 65.4%, Upper 20.5%, and Middle 14.1%. The Lower stock group from the commercial harvests, by percentage and number, were highest among all fisheries and districts (Figure 3).

Subsistence Districts 1–5

The Upper stock group dominated the District 1 subsistence harvest (51.3%), followed by 28.8% Middle and 19.9% Lower (Table 4; Figure 3). In District 2, the Upper stock group comprised a slightly lower (48.8%) percentage of the subsistence harvest, followed by a higher (40.3%) Middle percentage, and 10.9% Lower. In District 3, the Upper stock group dominated the subsistence harvest (47.5%), followed by 42.6% Middle and 9.9% Lower. The District 4 subsistence harvest was dominated by the Middle stock group (48.3%), followed by 45.5% Upper and just 6.2% Lower. By District 5, most of the subsistence harvest was from the Upper stock group (77.3%), followed by 21.6% Middle; the Lower stock group was mostly absent, comprising only 1.0% of harvest. The District 4 subsistence fishery harvested the largest number of fish from the Middle stock group and District 5 harvested the most fish from the Upper stock group (Table 3; Figure 3).

AGE COMPOSITION BY DISTRICT

Commercial Districts 1 and 2

In Districts 1 and 2, age-1.3 fish comprised nearly one-half of the commercial harvest (Tables 3 and 4). The District 1 commercial harvest comprised 48.2% age-1.3 fish, followed by 34.8% age-1.2, and 15.0% age-1.4 fish. In District 2, the age composition was 49.7% age-1.3, 32.9% age-1.2, and 15.3% age-1.4 fish (Table 4).

Subsistence Districts 1–6 and Canada

Age-1.3 fish was the most abundant age class harvested in subsistence fisheries from all U.S. districts and Canada (Table 4). The District 1 subsistence harvest comprised 57.6% age-1.3 fish, followed by 31.0% age-1.4, and 7.2% age-1.2 fish. In District 2, age-1.3 fish comprised an even higher (59.4%) percentage of the subsistence harvest, followed by 29.1% age-1.4 and 9.0% age-1.2 fish. Age-1.3 fish dominated in the District 3 subsistence harvest (54.6%), followed by 36.9% age-1.4, 4.7% age-1.5, and just 2.4% age-1.2 fish. District 3 estimates were based on 295 aged samples collected from the village of Holy Cross, which had the highest age-1.5 percentage (Tables 2 and 4). The District 4 subsistence harvest comprised 52.6% age-1.3 fish, followed by 32.9% age-1.4 and 9.7% age-1.2 fish (Table 4). In District 5, the age composition was 50.6% age-1.3, 24.1% age-1.3, and 20.1% age-1.2 fish. The District 6 subsistence and sport harvest was 56.7% age-1.3, 23.7% age-1.2, and 17.1% age-1.4 fish. The Canadian harvest comprised 46.2% age-1.3 fish, followed by 41.7% age-1.4 fish, and just 7.4% age-1.2 fish. In numbers of fish, the District 4 subsistence fishery harvested most age-1.3 (6,785) and age-1.4 fish (4,239); District 5 harvested the most age-1.2 fish (2,087; Table 3). Age-1.5 fish comprised the majority of the minor age classes (age-1.1, -2.2, -2.3, -1.5, -2.4, and -2.5; Table 4).

DISCUSSION

Harvest trends throughout the river can be explained by the distribution of each stock. In general, the harvest proportion of Canadian-origin fish increases with upriver distance, with the greatest proportional harvest from Subdistrict 5-D villages (Figure 1). Few Lower river stocks are available to upriver fishermen as these stocks mainly spawn downstream, yet Canadian-origin fish are available throughout the mainstem. The exception to this pattern is in Subdistrict 4-C, where fishing occurs along the south river bank (Figure 1). High catches of the Tanana River stock occur, which are south bank-oriented in that section of river. This is apparent in the 2010 Middle stock estimate from Ruby at 0.725 and also from Galena at 0.629 (Table 1). Decovich and Templin (2009) discuss the high proportion of Tanana River stock present in Ruby harvests.

The Upper stock group harvest was nearly 7 percentage points less than the 2005–2009 average (Table 6). This decrease was due in part to conservation measures adopted by Canadian aboriginal communities. The total Canadian harvest of 2,647 fish was less than half of the 2005–2009 average harvest (Table 5). Inseason information from the Alaska assessment projects indicated 2010 border escapement into Canada would not be met; therefore many Canadian fishermen decided to not fish or reduced their harvest (JTC 2011). This harvest reduction resulted in the lowest Canadian aboriginal harvest on record since the 1970s (JTC 2011) and contributed to the lowest Upper stock group harvest percentage since 1991 (Table 6).

Alaska fishermen from District 5 also voluntarily reduced their harvest. The preseason forecast for the 2010 Chinook salmon run was below average to average, and Canadian origin stocks were expected to be low. Subsistence conservation measures, less severe than 2009, were planned in order to meet escapement goals (Hayes and Buckelew 2010). Late run timing, wet and cold weather, high water, heavy debris loads, and high gasoline prices discouraged subsistence fishing in Alaska (Hayes and Buckelew 2010). Because of these adverse conditions additional conservation measures were not implemented. When the fish migration reached Subdistrict 5-D, it was apparent the run was weaker than expected and fishermen were asked to voluntarily reduce their harvest. In District 5, only 18% of the surveyed subsistence households responded that their Chinook salmon needs (76% to 100%) were met, the lowest of any U.S. Yukon River district (Jallen et al. 2012). The estimated District 5 harvest of 10,397 Chinook salmon was 4,214 fish below the 2005–2009 average harvest of 14,611 fish (Jallen et al. 2012).

District 5 fishermen had the largest Upper stock group harvest, yet voluntary reductions in harvest by these fishermen contributed substantially in reducing harvests of Canadian-origin fish.

In 2010, there were a total of 15 commercial fishing periods in Districts 1 and 2, with mesh size restricted to 6 inches or less, to target summer chum salmon. Chinook salmon incidentally caught were allowed to be sold. The commercial harvest did not begin until June 28, well past the midpoint of the Chinook salmon run, when Lower stock groups typically dominate (DeCovich et al. 2010). Of the 9,897 Chinook salmon sold, 6,440 fish (65.1%) were attributed to the Lower stock group (Table 3). Of the 4 strata used to apportion the commercial harvest, the last stratum had the highest (0.779) Lower stock proportion (Table 1).

Stock and age class composition estimates provide biological data necessary to manage fisheries and conserve Chinook salmon throughout the Yukon River drainage. In regard to age class composition, age-1.3 fish predominated among all harvest groups. The age-1.3 percentage was well above average and age-1.4 percentage was below average compared to historical data (Schumann and DuBois 2011).

Age-1.2 Chinook salmon in the commercial harvest accounted for 38.9% of the total age-1.2 harvest. The abundance of age-1.2 fish in the commercial harvest is primarily due to the use of 6-inch or less mesh, which is selective for smaller (i.e., shorter) Chinook salmon (Bromaghin 2005). The age-1.2 proportion was also high from subsistence harvests that primarily use fish wheels: Ruby (0.258), Tanana (0.212), Rampart Rapids (0.400), and Fort Yukon (0.220; Table 2). Fish wheels tend to harvest smaller, younger fish that migrate near shore and in areas of lower water velocity (Meehan 1961).

Through 2008, Canadian harvest age composition was derived from Chinook salmon caught in fish wheels and combined with Canadian commercial or test fishery age data. Beginning in 2009, the Eagle sonar test fishery, conducted with drift gillnets using 4 mesh sizes (5.25-, 6.5-, 7.5-, and 8.5-inch) was chosen to directly estimate the Canadian age composition. It is not known how representative the test fishery is of the Canadian harvest because the harvest was not sampled. Given known bias in harvest by fish wheels, and unknown relation between Eagle sonar test fishery and Canadian harvests, comparisons of Canadian harvest age composition should be considered cautiously.

ACKNOWLEDGMENTS

This project was made possible by employees of the Alaska Department of Fish and Game Divisions of Commercial Fisheries and Sport Fish, City of Kaltag, Ruby Tribal Council, Tanana Chiefs Conference, Stan Zuray (Rapids Research Center), Pat Moore (Tanana), University of Alaska Fairbanks, and U.S. Fish and Wildlife Service who collected scale and genetic samples from Chinook salmon in 2010. Age data were compiled by Kyle Schumann. Genetic analyses were performed by Heather Hoyt, Zac Grauvogel, and Mick Leach. Toshihide Hamazaki provided biometric review. Kathrine Howard and Jan Conitz reviewed draft manuscripts. Inseason analysis of genetic collections from test fishery harvests was funded by the 2010 Restoration and Enhancement Fund of the Yukon River Panel, project 19N-10.

REFERENCES CITED

Beacham, T. D., C. B. Murray, and R. E. Withler. 1989. Age, morphology, and biochemical genetic variation of Yukon River Chinook salmon. Transactions of the American Fisheries Society 118:46–63.

Bromaghin, J. F. 2005. A versatile net selectivity model, with application to Pacific salmon and freshwater species of the Yukon River. Alaska. Fisheries Research 74:157-168.

Clutter, R. I., and L. E. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Bulletin of the International Pacific Salmon Fisheries Commission 9, Vancouver, BC.

DeCovich, N. A., and K. G. Howard. 2010. Genetic stock identification of Chinook salmon harvest on the Yukon River 2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-58, Anchorage.

DeCovich, N. A., and K. G. Howard. 2011. Genetic stock identification of Chinook salmon harvest on the Yukon River 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-65, Anchorage.

DuBois, L. 2005. Origins of Chinook salmon in the Yukon River fisheries, 2003. Alaska Department of Fish and Game, Fishery Data Series No. 05-46, Anchorage.

Estensen, J. L., S. Hayes, S. Buckelew, D. Green, and D. J. Bergstrom. 2012. Annual management report for the Yukon and Northern areas 2010. Alaska Department of Fish and Game, Fishery Management Report No. 12-23, Anchorage.

Hayes, S. J., and S. Buckelew. 2010. Yukon River Informational Letter Summer Season, 2010. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

INPFC (International North Pacific Fisheries Commission). 1963. Annual report, 1961. Vancouver, BC.

Jallen, D. M., S. D. Ayers, and T. Hamazaki. 2012. Subsistence and personal use salmon harvests in the Alaska portion of the Yukon River drainage, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 12-18, Anchorage.

JTC (Joint Technical Committee of the Yukon River US/Canada Panel). 2011. Yukon River salmon 2010 season summary and 2011 season outlook. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A11-01, Anchorage.

Lingnau, T. L., and J. F. Bromaghin. 1999. Origins of Chinook salmon in the Yukon River fisheries, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A99-09, Anchorage.

Meehan, W. R. 1961. Use of a fish wheel in salmon research and management. Transactions of the American Fisheries Society 90(4):490-494.

Mosher, K. H. 1969. Identification of Pacific salmon and steelhead trout by scale characteristics. U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Circular 317.

Schneiderhan, D. J. 1997. A history of scale pattern analysis as applied to stock identification of Chinook and chum salmon in the Yukon River. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 3A97-33, Anchorage.

Schumann, K., and L. DuBois. 2011. Salmon age and sex composition and mean lengths for the Yukon River area, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-48, Anchorage.

Smith, C. T., W. D. Templin, J. E. Seeb, and L. W. Seeb. 2005. Single nucleotide polymorphisms (SNPs) provide rapid and accurate estimates of the proportions of U.S. and Canadian Chinook salmon caught in Yukon River fisheries. North American Journal of Fisheries Management 25:944-953.

Templin, W. D., R. L. Wilmot, C. M. Guthrie III, and L. W. Seeb. 2005. United States and Canadian Chinook salmon populations in the Yukon River can be segregated based on genetic characteristics. Alaska Fishery Research Bulletin 11(1):44-60.

Wilmot, R. L., R. J. Everett, W. J. Spearman, and R. Baccus. 1992. Genetic stock identification of Yukon River chum and Chinook salmon, 1987 to 1990 progress report. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, Anchorage.

TABLES AND FIGURES

Table 1.–Yukon River Chinook salmon genetic stock composition and harvest apportioned, 2010.

Harvest Apportioned	Sampling Location District/Subdistrict	Fishery / Project	Stock Group	Sample Size	Estimate [a]	90% CI
Y-1(P1) and Y-2 (P1)	Y-1, Y-2	Commercial	Lower	297	0.649	0.597–0.701
			Middle		0.105	0.067–0.149
			Upper		0.246	0.199–0.294
Y-1(P2) and Y-2 (P2)	Y-1, Y-2	Commercial	Lower	153	0.449	0.375–0.524
			Middle		0.209	0.148–0.275
			Upper		0.341	0.272–0.413
Y-1(P3, P4) and Y-2 (P3)	Y-1, Y-2	Commercial	Lower	200	0.656	0.592–0.717
			Middle		0.131	0.083–0.186
			Upper		0.213	0.160–0.270
Y-1(P5 - P8) and Y-2 (P4 - P7)	Y-1, Y-2	Commercial	Lower	228	0.779	0.726–0.830
			Middle		0.140	0.096–0.188
			Upper		0.081	0.048–0.119
Y-1 Commercial [b]			Lower		0.648	
			Middle		0.135	
			Upper		0.217	
Y-2 Commercial [b]			Lower		0.654	
			Middle		0.141	
			Upper		0.145	
	Y-1	LYTF Stratum 1 (June 11–19)	Lower	228	0.223	0.171–0.279
			Middle		0.240	0.176-0.307
			Upper		0.537	0.467–0.607
	Y-1	LYTF Stratum 2 (June 20–25)	Lower	219	0.175	0.127–0.228
			Middle		0.337	0.269–0.407
			Upper		0.488	0.419–0.557
Y-1 Subsistence		Combined [c]	Lower		0.199	
			Middle		0.288	
			Upper		0.513	
	Y-2	Pilot Station Sonar Test Fishery Stratum 1 (June 12–21)	Lower	95	0.081	0.030–0.148
			Middle		0.431	0.319–0.544
			Upper		0.489	0.380–0.595
	Y-2	Pilot Station Sonar Test Fishery Stratum 2 (June 22–28)	Lower	152	0.137	0.081–0.205
			Middle		0.376	0.283–0.473
			Upper		0.487	0.395–0.578
Y-2 Subsistence		Combined [c]	Lower		0.109	
			Middle		0.403	
			Upper		0.488	

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Table 1.–Page 2 of 3.

Harvest Apportioned	Sampling Location District/Subdistrict	Fishery / Project	Stock Group	Sample Size	Estimate [a]	90% CI
Y-2 Sport [d]			Lower		1.000	
Y-3 Subsistence	Y-3	Holy Cross Subsistence	Lower	197	0.099	0.055–0.152
			Middle		0.426	0.342–0.513
			Upper		0.475	0.392–0.557
	Y-4A	Kaltag Subsistence	Lower	240	0.065	0.019–0.118
			Middle		0.424	0.345–0.502
			Upper		0.510	0.445–0.576
	Y-4A	Nulato Subsistence	Lower	194	0.037	0.002–0.081
			Middle		0.460	0.371–0.550
			Upper		0.503	0.418–0.588
Anvik, Grayling, Kaltag, Nulato, and Koyukuk Subsistence		Combined [c]	Lower		0.051	
			Middle		0.442	
			Upper		0.507	
	Y-4BC	Bishop Rock Subsistence	Lower	113	0.146	0.069–0.237
			Middle		0.354	0.249–0.469
			Upper		0.500	0.392–0.602
	Y-4ABC	Galena Subsistence	Lower	198	0.068	0.031–0.112
			Middle		0.629	0.549–0.709
			Upper		0.303	0.230–0.379
Koyukuk and Galena Subsistence		Combined [c]	Lower		0.107	
			Middle		0.492	
			Upper		0.401	
Ruby Subsistence	Y-4BC	Ruby Subsistence	Lower	226	0.075	0.028–0.134
			Middle		0.725	0.653–0.793
			Upper		0.199	0.146–0.256
Koyukuk River Subsistence [d]			Middle		1.000	
Y-4 Subsistence [e]			Lower		0.062	
			Middle		0.483	
			Upper		0.455	

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Table 1.–Page 3 of 3.

Harvest Apportioned	Sampling Location District/Subdistrict	Fishery / Project	Stock Group	Sample Size	Estimate [a]	90% CI
Tanana Subsistence	Y-5AB	Tanana Subsistence	Lower	200	0.012	0.000–0.034
			Middle		0.216	0.148–0.288
			Upper		0.772	0.701–0.840
	Y-5B	Rampart Rapids Subsistence Stratum 1 (July 5–12)	Lower Middle	100	0.202	0.096–0.316
			Upper		0.798	0.684–0.904
	Y-5B	Rampart Rapids Subsistence Stratum 2 (July 13–17)	Lower Middle	100	0.205	0.109–0.311
			Upper		0.795	0.689–0.891
	Y-5D	Fort Yukon Subsistence	Lower	192	0.011	0.000–0.031
			Middle		0.086	0.032–0.147
			Upper		0.904	0.841–0.959
Rampart to Fort Yukon Subsistence		Combined [c, f]	Lower		0.014	
			Middle		0.154	
			Upper		0.832	
Above Fort Yukon to U.S./Canada Border Subsistence [d]			Upper		1.000	
Chandalar and Black Rivers Subsistence [d]			Middle		1.000	
Y-5 Subsistence [e]			Lower		0.010	
			Middle		0.216	
			Upper		0.773	
Y-6 Subsistence/Sport [d]			Middle		1.000	
Canada [d]			Upper		1.000	

[a] Stock composition estimates are from DeCovich and Howard (2011).

[b] District stock composition estimate is derived from the sum of the commercial harvest period estimates and weighted by each period's respective harvest.

[c] Combined stock composition estimates were averaged by stock group.

[d] Assigned to stock group based on geographic location.

[e] District stock composition estimate is derived from the sum of the area estimates and weighted by each area's respective harvest.

[f] The combined lower and middle proportion from Rampart Rapids was split by 0.075 lower and 0.925 middle (Nick DeCovich, Genetics Biologist, ADF&G, Anchorage, personal communication).

Table 2.–Yukon River Chinook salmon age class proportion and harvest apportioned, 2010.

Harvest Apportioned [a]	Harvest	Sampling Location	Fishery / Project [a,b]	Gear [c]	No. Samples [d]	Proportion by age class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5
		Y-1	Comm (P1, 6/28) [e]	≤ 6" mesh	200	0.000	0.505	0.370	0.000	0.120	0.005	0.000	0.000	0.000
		Y-2	Comm (P1, 7/1) [e]	≤ 6" mesh	158	0.000	0.418	0.430	0.000	0.146	0.006	0.000	0.000	0.000
Y-1 (P1) and Y-2 (P1) Comm	3,337		Combined [f]	≤ 6" mesh	358	0.000	0.466	0.397	0.000	0.131	0.006	0.000	0.000	0.000
		Y-1	Comm (P2, 7/2) [e]	≤ 6" mesh	141	0.007	0.298	0.539	0.000	0.121	0.007	0.028	0.000	0.000
		Y-2	Comm (P2, 7/4) [g]	≤ 6" mesh	13	0.000	0.231	0.769	0.000	0.000	0.000	0.000	0.000	0.000
Y-1 (P2) and Y-2 (P2) Comm	1,657		Combined [f]	≤ 6" mesh	154	0.006	0.292	0.558	0.000	0.110	0.006	0.026	0.000	0.000
		Y-1	Comm (P3, 7/3) [e]	≤ 6" mesh	162	0.000	0.216	0.537	0.000	0.210	0.006	0.025	0.006	0.000
		Y-1	Comm (P4, 7/6) [g]	≤ 6" mesh	157	0.000	0.389	0.478	0.000	0.121	0.000	0.013	0.000	0.000
		Y-2	Comm (P3, 7/7) [g]	≤ 6" mesh	34	0.000	0.294	0.559	0.000	0.118	0.000	0.029	0.000	0.000
Y-1 (P3, P4) and Y-2 (P3) Comm	2,376		Combined [f]	≤ 6" mesh	353	0.000	0.300	0.513	0.000	0.161	0.003	0.020	0.003	0.000
		Y-1	Comm (P5, 7/9) [g]	≤ 6" mesh	78	0.000	0.205	0.564	0.000	0.218	0.000	0.013	0.000	0.000
		Y-1	Comm (P6, 7/11) [g]	≤ 6" mesh	112	0.000	0.232	0.509	0.000	0.232	0.000	0.027	0.000	0.000
		Y-2	Comm (P4, 7/10) [g]	≤ 6" mesh	67	0.000	0.269	0.507	0.000	0.179	0.030	0.000	0.015	0.000
		Y-2	Comm (P5, 7/12) [g]	≤ 6" mesh	14	0.000	0.429	0.571	0.000	0.000	0.000	0.000	0.000	0.000
Y-1 (P5, P6) and Y-2 (P4, P5) Comm	1,733		Combined [f]	≤ 6" mesh	271	0.000	0.244	0.528	0.000	0.203	0.007	0.015	0.004	0.000
		Y-1	Comm (P7, 7/13) [g]	≤ 6" mesh	35	0.000	0.200	0.600	0.000	0.200	0.000	0.000	0.000	0.000
		Y-1	Comm (P8, 7/15) [g]	≤ 6" mesh	5	0.000	0.400	0.600	0.000	0.000	0.000	0.000	0.000	0.000
		Y-2	Comm (P6, 7/14) [g]	≤ 6" mesh	188	0.011	0.239	0.564	0.000	0.176	0.000	0.005	0.005	0.000
Y-1 (P7, P8) and Y-2 (P6, P7) Comm	794		Combined [f]	≤ 6" mesh	228	0.009	0.237	0.570	0.000	0.175	0.000	0.004	0.004	0.000

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Table 2.–Page 2 of 4.

Harvest Apportioned [a]	Harvest	Sampling Location	Fishery / Project [a,b]	Gear [c]	No. Samples [d]	Proportion by age class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5
Y-1 Comm [h]	5,744					0.001	0.348	0.482	0.000	0.150	0.005	0.012	0.002	0.000
Y-2 Comm [h]	4,153					0.002	0.329	0.497	0.000	0.153	0.005	0.012	0.002	0.000
		Y-1	Sub [e]	“Chum” and “King” mesh	77	0.000	0.104	0.558	0.000	0.286	0.013	0.039	0.000	0.000
		Y-1	LYTF [e]	8.5" mesh	1,328	0.002	0.041	0.594	0.002	0.334	0.002	0.023	0.003	0.000
Y-1 Sub	5,856		Combined [i]	“Chum,” “King,” and 8.5" mesh		0.001	0.072	0.576	0.001	0.310	0.008	0.031	0.002	0.000
Y-2 Sub	8,676	Y-2	Pilot Station TF [e]	5.25", 5.75", 6.5", 7.5", and 8.5" mesh	234	0.000	0.090	0.594	0.000	0.291	0.004	0.017	0.004	0.000
		Lower Yukon R. tributaries	E. F. Andreafsky R. Weir [e]	weir trap	624	0.003	0.413	0.451	0.017	0.098	0.007	0.009	0.001	0.001
			Anvik R. [e]	hand-picked	108	0.018	0.348	0.509	0.009	0.116	0.000	0.000	0.000	0.000
Y-2 Sport	161		Combined [j]	weir trap and hand-picked		0.010	0.381	0.480	0.013	0.107	0.004	0.005	0.000	0.000
Y-3 Sub	4,299	Y-3	Holy Cross Sub [e]	8.25" and 8.5" mesh	295	0.000	0.024	0.546	0.000	0.369	0.003	0.047	0.010	0.000
		Y-4A	Anvik Sub [e]	8" and 8.25" mesh	162	0.000	0.037	0.512	0.000	0.389	0.000	0.062	0.000	0.000
		Y-4A	Kaltag Sub [e]	8.25" mesh	232	0.000	0.073	0.500	0.000	0.371	0.013	0.026	0.017	0.000
		Y-4A	Nulato Sub [e]	unknown mesh	177	0.000	0.096	0.588	0.000	0.282	0.023	0.000	0.011	0.000
Anvik, Grayling, Kaltag, and Nulato Sub	9,371		Combined [f]	unknown, 8", and 8.25" mesh	571	0.000	0.070	0.531	0.000	0.349	0.012	0.028	0.011	0.000
		Y-4BC	Bishop Rock Sub [e]	8.25" mesh	106	0.000	0.047	0.434	0.000	0.491	0.009	0.019	0.000	0.000
		Y-4ABC	Galena Sub [e]	7.5", 8", 8.25", and 8.5", and unknown mesh; FW	215	0.000	0.144	0.502	0.000	0.307	0.005	0.037	0.005	0.000
Koyukuk and Galena Sub	2,224		Combined [f]	7.5", 8", 8.25", and 8.5", and unknown mesh; FW	321	0.000	0.112	0.480	0.000	0.368	0.006	0.031	0.003	0.000

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Table 2.–Page 3 of 4.

Harvest Apportioned [a]	Harvest	Sampling Location	Fishery / Project [a,b]	Gear [c]	No. Samples [d]	Proportion by age class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5
Ruby Sub	1,102	Y-4BC	Ruby Sub [e]	4", 6", 8", 8.25", and 8.5" mesh; FW	155	0.000	0.258	0.587	0.000	0.116	0.000	0.032	0.006	0.000
		Koyukuk River tributaries	Gisasa R. Weir [e]	weir trap	492	0.003	0.437	0.461	0.006	0.080	0.007	0.003	0.002	0.000
			Henshaw Ck. Weir [e]	weir trap	208	0.006	0.193	0.572	0.005	0.208	0.005	0.005	0.006	0.000
Koyukuk R. Sub	191		Combined [k]	weir trap		0.004	0.315	0.517	0.005	0.144	0.006	0.004	0.004	0.000
Y-4 Sub [l]	12,888					0.000	0.097	0.526	0.000	0.329	0.010	0.029	0.009	0.000
Tanana Sub	3,215	Y-5AB	Tanana [e]	fish wheel		0.000	0.212	0.507	0.003	0.222	0.010	0.035	0.007	0.003
		Y-5B	Rampart Rapids Sub [e]	FW	35	0.029	0.400	0.486	0.000	0.086	0.000	0.000	0.000	0.000
		Y-5C	Hess Creek Sub [e]	8" mesh	213	0.000	0.070	0.376	0.000	0.460	0.019	0.056	0.019	0.000
		Y-5D	Fort Yukon Sub [e]	6" mesh and FW	153	0.000	0.190	0.575	0.000	0.209	0.007	0.020	0.000	0.000
Rampart to Fort Yukon Sub. Chandalar and Black rivers Sub.	5,901		Combined [m]	6" and 8" mesh, FW		0.010	0.220	0.479	0.000	0.252	0.008	0.025	0.006	0.000
Circle, Central, and Eagle Sub	1,281	Y-5D	Eagle Sub [e]	6" mesh and FW	175	0.000	0.086	0.629	0.000	0.240	0.017	0.023	0.006	0.000
Y-5 Sub [l]	10,397					0.005	0.201	0.506	0.001	0.241	0.001	0.028	0.006	0.001
		Tanana R. tributaries	Chena R. [e]	hand-picked	80	0.000	0.136	0.506	0.012	0.321	0.000	0.025	0.000	0.000
			Salcha R. [e]	hand-picked	410	0.005	0.255	0.575	0.005	0.141	0.007	0.005	0.007	0.000
Y-6 Sub/Sport	1,608		Combined [f]	hand-picked	490	0.004	0.235	0.564	0.006	0.170	0.006	0.008	0.006	0.000
Canada	2,647	Y-5D	Eagle Sonar TF [e]	5.25", 6.5", 7.5", and 8.5" mesh	338	0.000	0.074	0.462	0.000	0.417	0.006	0.030	0.012	0.000

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Table 2.–Page 4 of 4.

[a] Comm is commercial, P is commercial period followed by period number, and Sub is subsistence.
[b] Date is commercial period closing date, LYTF is Lower Yukon test fishery, and TF is test fishery.
[c] Mesh sizes refer to drift and/or set gillnets, FW is fish wheel, and hand-picked is carcass sampling from spawning grounds.
[d] Samples combined by number of fish show combined sample size. Samples combined by proportions do not show sample size.
[e] From Schumann and DuBois (2011).
[f] Sample sizes by age were summed and combined proportion was derived from the sum.
[g] From AYKDBMS (Arctic-Yukon-Kuskokwim Database Management System) http://www.adfg.alaska.gov/CommFishR3/Website/AYKDBMSWebsite/DataTypes/ASL.aspx
[h] District age composition estimate is derived from the sum of the commercial harvest period estimates and weighted by each period's respective harvest.
[i] Proportions by age were averaged from the subsistence harvest proportion (“Chum” and “King” meshes) and the Lower Yukon test fishery proportion.
[j] Proportions by age were averaged from the East Fork Andreafsky River weir trap Anvik River hand-picked proportions.
[k] Proportions by age were averaged from the Gisasa and Henshaw river weir proportions.
[l] District age composition estimate is derived from the sum of the area estimates and weighted by each area's respective harvest.
[m] Proportions by age were averaged from the Rampart Rapids, Hess Creek, and Fort Yukon proportions.

Table 3.–Yukon River Chinook salmon harvest by age class, stock group, and fishery, 2010.

District	Fishery	Stock Group	Age Class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
1	Commercial	Lower	5	1,289	1,791	0	573	18	42	7	0	3,725
		Middle	2	258	384	0	115	4	11	1	0	775
		Alaska	6	1,548	2,175	0	688	22	53	8	0	4,500
		Upper	2	452	593	0	174	6	15	1	0	1,244
		Total	8	2,000	2,769	0	861	29	68	9	0	5,744
	Subsistence	Lower	1	84	672	1	361	9	36	2	0	1,165
		Middle	1	122	972	1	522	13	53	3	0	1,687
		Alaska	2	206	1,644	2	883	22	89	4	0	2,853
		Upper	2	217	1,731	2	930	23	94	5	0	3,003
		Total	4	423	3,375	4	1,813	45	182	9	0	5,856
2	Commercial	Lower	6	883	1,349	0	428	13	31	6	0	2,715
		Middle	2	185	299	0	88	3	8	1	0	586
		Alaska	7	1,067	1,648	0	516	16	40	7	0	3,301
		Upper	2	297	418	0	118	4	12	1	0	852
		Total	10	1,364	2,066	0	634	20	51	8	0	4,153
	Subsistence	Lower	0	85	562	0	275	4	16	4	0	946
		Middle	0	314	2079	0	1017	15	60	15	0	3,500
		Alaska	0	399	2641	0	1292	19	76	19	0	4,446
		Upper	0	380	2513	0	1229	18	72	18	0	4,230
		Total	0	779	5,154	0	2,521	37	148	37	0	8,676
	Sport	Lower	2	61	77	2	17	1	1	0	0	161
3	Subsistence	Lower	0	10	233	0	158	1	20	4	0	427
		Middle	0	43	999	0	676	6	87	19	0	1,830
		Alaska	0	54	1231	0	834	8	107	23	0	2,256
		Upper	0	48	1115	0	755	7	97	21	0	2,043
		Total	0	102	2,346	0	1588	15	204	44	0	4,299
4	Subsistence	Lower	0	82	416	0	263	7	23	6	0	798
		Middle	1	679	3,292	1	1,967	59	177	53	0	6,229
		Alaska	1	761	3,708	1	2,230	66	200	59	0	7,026
		Upper	0	489	3,078	0	2,009	64	168	54	0	5,862
		Total	1	1,250	6,785	1	4,239	130	368	113	0	12,888
5	Subsistence	Lower	1	24	53	0	26	1	3	1	0	109
		Middle	13	488	1,103	3	540	21	65	15	3	2,251
		Alaska	14	512	1,156	3	567	22	68	15	3	2,360
		Upper	41	1,576	4,110	9	1,935	84	224	51	9	8,037
		Total	54	2,087	5,266	12	2,501	106	292	67	12	10,397
6	Subsistence	Middle	5	307	736	8	222	8	11	8	0	1,305
	Sport	Middle	1	74	177	2	53	2	3	2	0	313
		Total	7	381	912	0	275	10	13	10	0	1,608
Canada	Aboriginal	Upper	0	196	1,222	0	1,104	16	78	31	0	2,647
Total Harvest		Lower	13	2,518	5,153	3	2,101	55	173	29	0	10,046
		Middle	25	2,471	10,040	5	5,201	130	474	116	3	18,465
		Alaska	38	4,989	15,193	8	7,302	185	647	145	3	28,511
		Upper	47	3,655	14,779	11	8,253	222	760	182	9	27,918
		Total	86	8,644	29,972	19	15,556	407	1,406	327	12	56,429

Table 4.–Yukon River Chinook salmon harvest percentage by age class, stock group, and fishery, 2010.

District	Fishery	Stock Group	Age Class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
1	Commercial	Lower	0.1	22.4	31.2	0.0	10.0	0.3	0.7	0.1	0.0	64.8
		Middle	0.0	4.5	6.7	0.0	2.0	0.1	0.2	0.0	0.0	13.5
		Alaska	0.1	26.9	37.9	0.0	12.0	0.4	0.9	0.1	0.0	78.3
		Upper	0.0	7.9	10.3	0.0	3.0	0.1	0.3	0.0	0.0	21.7
		Total	0.1	34.8	48.2	0.0	15.0	0.5	1.2	0.2	0.0	100.0
	Subsistence	Lower	0.0	1.4	11.5	0.0	6.2	0.2	0.6	0.0	0.0	19.9
		Middle	0.0	2.1	16.6	0.0	8.9	0.2	0.9	0.0	0.0	28.8
		Alaska	0.0	3.5	28.1	0.0	15.1	0.4	1.5	0.1	0.0	48.7
		Upper	0.0	3.7	29.6	0.0	15.9	0.4	1.6	0.1	0.0	51.3
		Total	0.1	7.2	57.6	0.1	31.0	0.8	3.1	0.2	0.0	100.0
2	Commercial	Lower	0.1	21.3	32.5	0.0	10.3	0.3	0.7	0.1	0.0	65.4
		Middle	0.0	4.5	7.2	0.0	2.1	0.1	0.2	0.0	0.0	14.1
		Alaska	0.2	25.7	39.7	0.0	12.4	0.4	1.0	0.2	0.0	79.5
		Upper	0.1	7.1	10.1	0.0	2.8	0.1	0.3	0.0	0.0	20.5
		Total	0.2	32.9	49.7	0.0	15.3	0.5	1.2	0.2	0.0	100.0
	Subsistence	Lower	0.0	1.0	6.5	0.0	3.2	0.0	0.2	0.0	0.0	10.9
		Middle	0.0	3.6	24.0	0.0	11.7	0.2	0.7	0.2	0.0	40.3
		Alaska	0.0	4.6	30.4	0.0	14.9	0.2	0.9	0.2	0.0	51.2
		Upper	0.0	4.4	29.0	0.0	14.2	0.2	0.8	0.2	0.0	48.8
		Total	0.0	9.0	59.4	0.0	29.1	0.4	1.7	0.4	0.0	100.0
	Sport	Lower	1.0	38.1	48.0	1.3	10.7	0.4	0.5	0.0	0.0	100.0
3	Subsistence	Lower	0.0	0.2	5.4	0.0	3.7	0.0	0.5	0.1	0.0	9.9
		Middle	0.0	1.0	23.2	0.0	15.7	0.1	2.0	0.4	0.0	42.6
		Alaska	0.0	1.2	28.6	0.0	19.4	0.2	2.5	0.5	0.0	52.5
		Upper	0.0	1.1	25.9	0.0	17.6	0.2	2.3	0.5	0.0	47.5
		Total	0.0	2.4	54.6	0.0	36.9	0.3	4.7	1.0	0.0	100.0
4	Subsistence	Lower	0.0	0.6	3.2	0.0	2.0	0.1	0.2	0.0	0.0	6.2
		Middle	0.0	5.3	25.5	0.0	15.3	0.5	1.4	0.4	0.0	48.3
		Alaska	0.0	5.9	28.8	0.0	17.3	0.5	1.6	0.5	0.0	54.5
		Upper	0.0	3.8	23.9	0.0	15.6	0.5	1.3	0.4	0.0	45.5
		Total	0.0	9.7	52.6	0.0	32.9	1.0	2.9	0.9	0.0	100.0
5	Subsistence	Lower	0.0	0.2	0.5	0.0	0.3	0.0	0.0	0.0	0.0	1.0
		Middle	0.1	4.7	10.6	0.0	5.2	0.2	0.6	0.1	0.0	21.6
		Alaska	0.1	4.9	11.1	0.0	5.5	0.2	0.7	0.1	0.0	22.7
		Upper	0.4	15.2	39.5	0.1	18.6	0.8	2.2	0.5	0.1	77.3
		Total	0.5	20.1	50.6	0.1	24.1	1.0	2.8	0.6	0.1	100.0
6	Subsistence	Middle	0.3	19.1	45.8	0.5	13.8	0.5	0.7	0.5	0.0	81.1
	Sport	Middle	0.1	4.6	11.0	0.1	3.3	0.1	0.2	0.1	0.0	19.5
		Total	0.4	23.7	56.7	0.0	17.1	0.6	0.8	0.6	0.0	100.0
Canada	Aboriginal	Upper	0.0	7.4	46.2	0.0	41.7	0.6	3.0	1.2	0.0	100.0
Total Harvest		Lower	0.0	4.5	9.1	0.0	3.7	0.1	0.3	0.1	0.0	17.8
		Middle	0.0	4.4	17.8	0.0	9.2	0.2	0.8	0.2	0.0	32.7
		Alaska	0.1	8.8	26.9	0.0	12.9	0.3	1.1	0.3	0.0	50.5
		Upper	0.1	6.5	26.2	0.0	14.6	0.4	1.3	0.3	0.0	49.5
		Total	0.2	15.3	53.1	0.0	27.6	0.7	2.5	0.6	0.0	100.0

Table 5.–Yukon River Chinook salmon harvest numbers by stock group for U.S. and Canada, 1981–2010.

			Upper			
Year	Lower	Middle	U.S.	Canada	Total	Total
1981	11,164	112,669	64,644	18,109	82,753	206,586
1982	23,601	41,967	87,241	17,208	104,449	170,017
1983	28,081	73,361	96,994	18,952	115,946	217,388
1984	45,210	71,656	44,735	16,795	61,530	178,396
1985	57,770	46,753	85,773	19,301	105,074	209,597
1986	32,517	15,894	97,593	20,364	117,957	166,368
1987	32,847	40,281	115,258	17,614	132,872	206,000
1988	36,967	26,805	84,649	21,427	106,076	169,848
1989	42,872	27,936	86,798	17,944	104,742	175,550
1990	34,007	42,430	72,996	19,227	92,223	168,660
1991	49,113	44,328	61,210	20,607	81,817	175,258
1992	30,330	40,600	97,261	17,903	115,164	186,094
1993	38,592	45,671	78,815	16,611	95,426	179,689
1994	35,161	41,488	95,666	21,218	116,884	193,533
1995	35,518	44,404	97,741	20,887	118,628	198,550
1996	33,278	16,386	88,958	19,612	108,570	158,234
1997	50,420	32,043	92,162	16,528	108,690	191,153
1998	34,759	18,509	46,947	5,937	52,884	106,152
1999	54,788	8,619	60,908	12,468	73,376	136,783
2000	16,989	6,176	22,143	4,879	27,022	50,187
2001	20,115	10,190	23,325	10,139	33,421	63,726
2002	14,895	22,395	30,058	9,257	39,387	76,677
2003	7,394	31,232	59,940	9,619	69,559	108,185
2004	18,965	35,553	57,831	11,238	69,069	123,587
2005	19,893	20,607	44,650	11,074	55,724	96,223
2006	18,301	28,756	48,097	9,072	57,169	104,225
2007	12,311	28,924	48,320	5,094	53,414	94,649
2008	8,903	14,636	25,329	3,426	28,755	52,294
2009	4,332	12,229	17,646	4,758	22,404	38,964
2010	10,046	18,465	25,271	2,647	27,918	56,429
5-Year Avg. (2005–2009)	12,748	21,030	36,808	6,685	43,493	77,271

Table 6.–Yukon River Chinook salmon harvest percentages by stock group for U.S. and Canada, 1981–2010.

			Upper		
Year	Lower	Middle	U.S.	Canada	Total
1981	5.4	54.5	31.3	8.8	40.1
1982	13.9	24.7	51.3	10.1	61.4
1983	12.9	33.7	44.6	8.7	53.3
1984	25.3	40.2	25.1	9.4	34.5
1985	27.6	22.3	40.9	9.2	50.1
1986	19.5	9.6	58.7	12.2	70.9
1987	15.9	19.6	56.0	8.6	64.5
1988	21.8	15.8	49.8	12.6	62.5
1989	24.4	15.9	49.4	10.2	59.7
1990	20.2	25.2	43.3	11.4	54.7
1991	28.0	25.3	34.9	11.8	46.7
1992	16.3	21.8	52.3	9.6	61.9
1993	21.5	25.4	43.9	9.2	53.1
1994	18.2	21.4	49.4	11.0	60.4
1995	17.9	22.4	49.2	10.5	59.7
1996	21.0	10.4	56.2	12.4	68.6
1997	26.4	16.8	48.2	8.6	56.9
1998	32.7	17.4	44.2	5.6	49.8
1999	40.1	6.3	44.5	9.1	53.6
2000	33.9	12.3	44.1	9.7	53.8
2001	31.6	16.0	36.5	15.9	52.4
2002	19.4	29.2	39.3	12.1	51.4
2003	6.8	28.9	55.4	8.9	64.3
2004	15.3	28.8	46.8	9.1	55.9
2005	20.7	21.4	46.4	11.5	57.9
2006	17.6	27.6	46.1	8.7	54.9
2007	13.0	30.6	51.1	5.4	56.4
2008	17.0	28.0	48.4	6.6	55.0
2009	11.1	31.4	45.3	12.2	57.5
2010	17.8	32.7	44.8	4.7	49.5
5-Year Avg. (2005–2009)	16.5	27.2	47.6	8.7	56.3

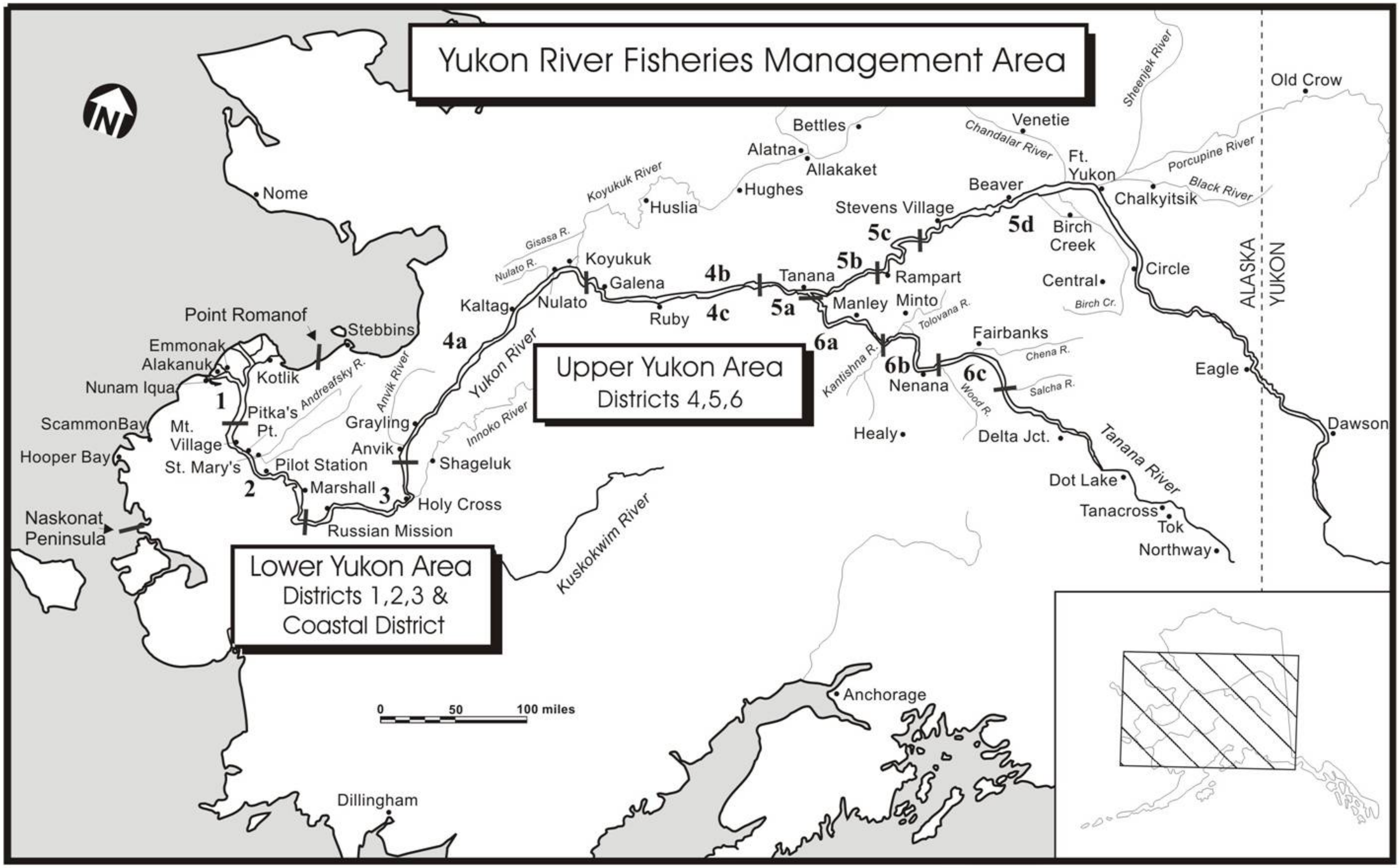


Figure 1.–Alaska portion of the Yukon River drainage with district boundaries and major spawning tributaries.

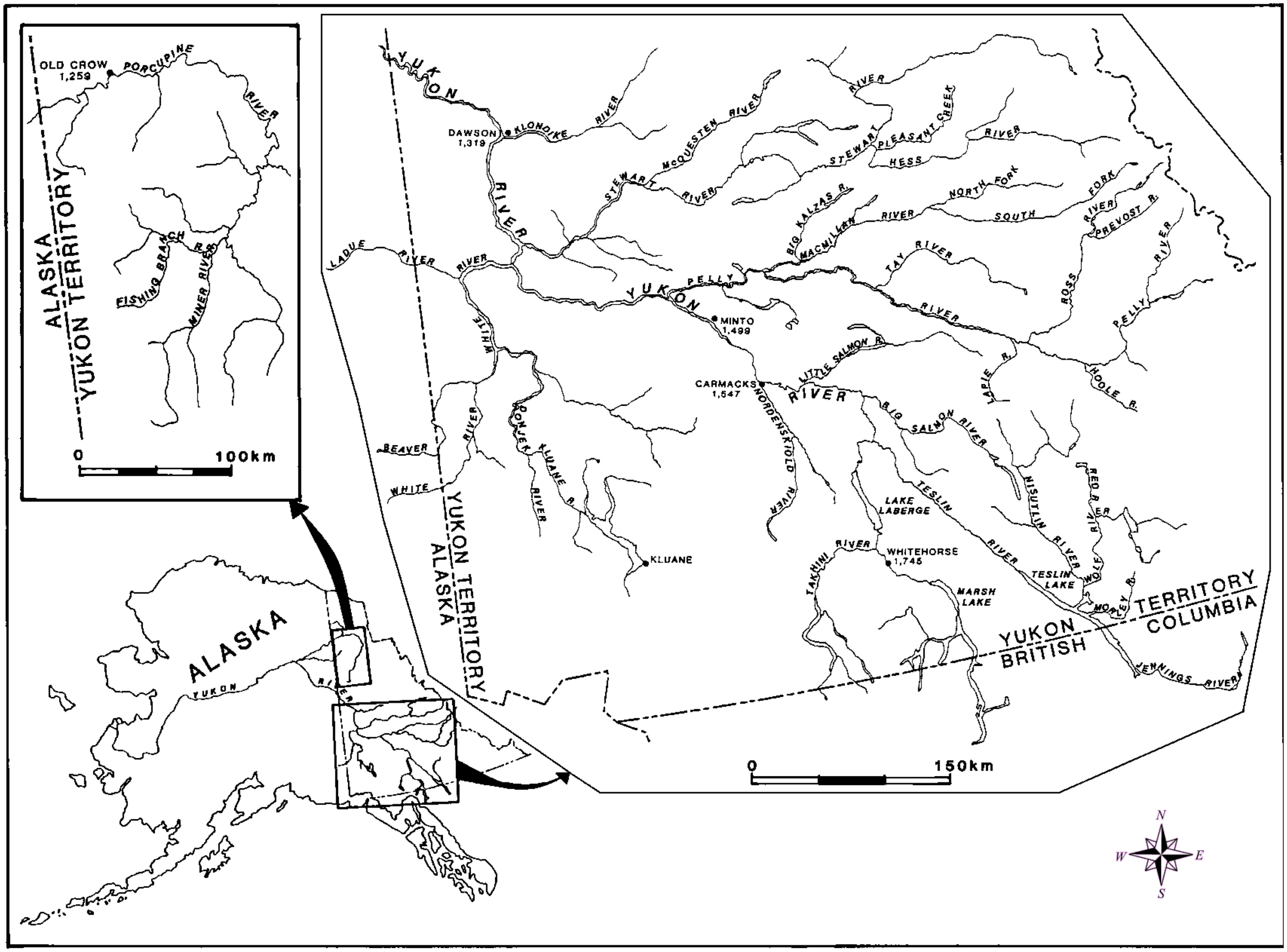
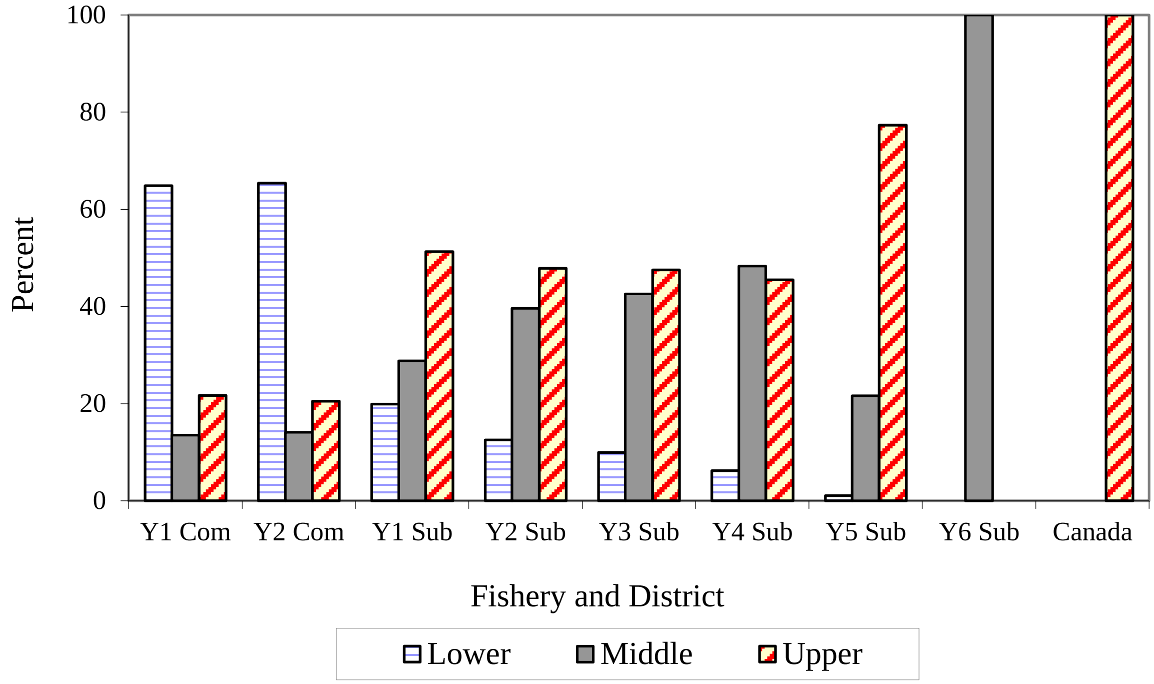
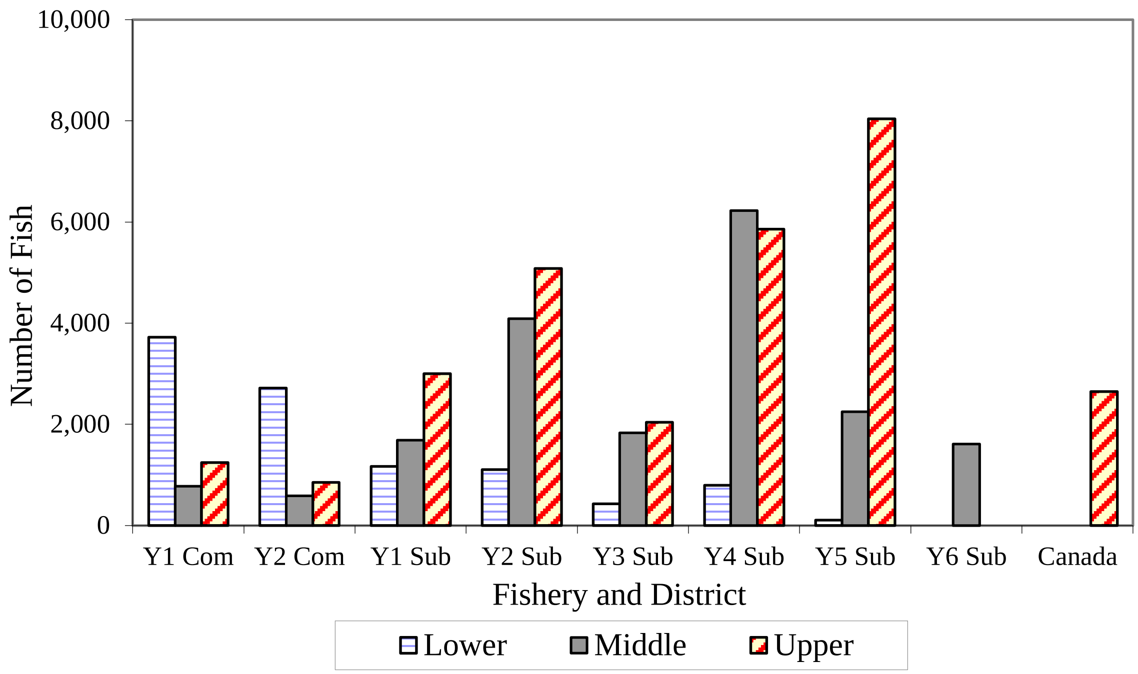


Figure 2.–Canadian portion of the Yukon River drainage and major spawning tributaries.





Note: District Y2 subsistence and Y6 subsistence includes sport harvest.

Figure 3.–Genetic stock composition from Yukon River harvests by fishery and district, by percentage (top) and number (bottom), 2010.